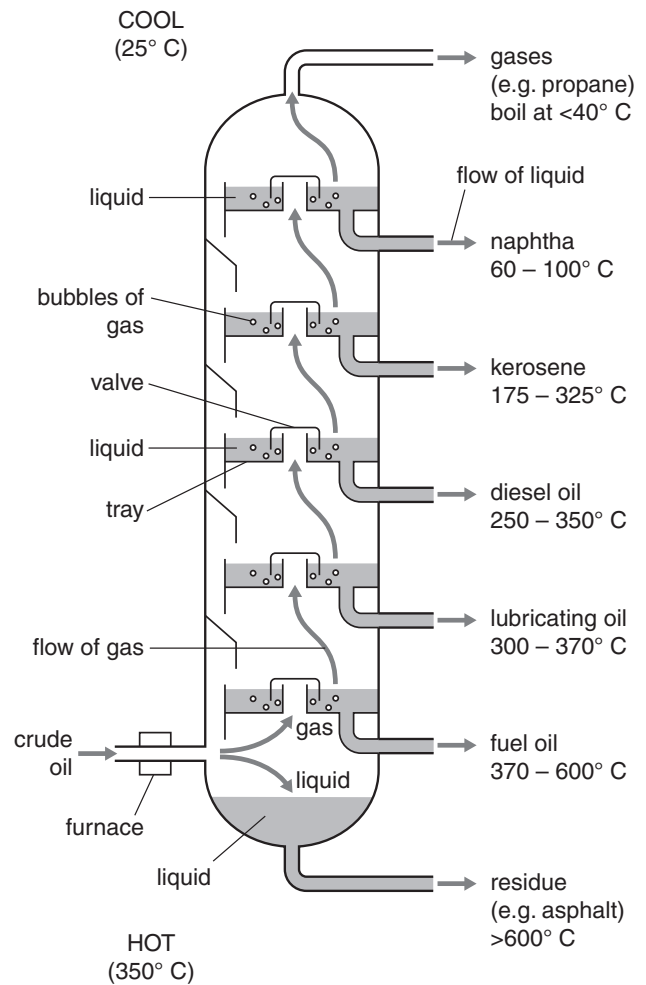


1 Study this diagram of the oil distillation process. Circle T (true) or F (false) in the description.

Crude oil is heated and pumped into the column (1. T / F). When this happens, all the crude oil evaporates and the vapour (or gas) rises through the column (2. T / F). As the vapour goes up the column, the temperature decreases (3. T / F). All the vapour from the crude oil flows to the top of the column and leaves it through a pipe (4. T / F). When the temperature falls to between 175° C and 325° C, some of the vapour condenses into liquid kerosene (5. T / F). This substance condenses at a higher temperature than naphtha. (6. T / F).



2 Read the description of the distillation process and answer the questions on the next page.

The oil refining process: fractional distillation

Crude oil (also called petroleum) is a mixture of different hydrocarbons. Many useful products can be made from these hydrocarbons. But first the useful ones must be extracted from the crude oil and separated from one another. How is this done?

The different hydrocarbon components of crude oil are called fractions. The fractions are separated from one another using a process called fractional distillation. This process is based on the principle that different substances boil at different temperatures. For example, crude oil contains kerosene and naphtha, which are useful fractions (naphtha is made into petrol for cars, and kerosene is made into jet fuel). When you evaporate the mixture of kerosene and naphtha, and then cool it, the kerosene condenses at a higher temperature than the naphtha. As the mixture cools, the kerosene condenses first, and the naphtha condenses later.

This is how fractional distillation works. The main equipment is a tall cylinder called a fractionator (or fractional distillation column). Inside this column there are many trays, or horizontal plates, all located at different heights. Each tray collects a different fraction when it cools to its own boiling point and condenses.

The crude oil is heated to at least 350°C, which makes most of the oil evaporate. The fluid then enters the column. As the vapour moves up through the fractionator, each fraction cools and condenses at a different temperature. As each fraction condenses, the liquid is collected in the trays. Substances with higher boiling points condense on the lower trays in the column. Substances with lower boiling points condense on the higher trays.

The trays have valves, which allow the vapour to bubble through the liquid in the tray. This helps the vapour to cool and condense more quickly. The liquid from each tray then flows out of the column.

Answer these questions on the reading text in your exercise book:

- 1 Why do different substances need to be extracted from crude oil?
- 2 What fact of science does fractional distillation use?
- 3 Which component of the column collects the condensed liquid from each fraction?
- 4 What is the function of the valves on each tray?

3 Put these stages in the distillation process into the correct order. Write a number (1 – 8) next to each stage.

- A As the vapour rises through the trays in the column, the temperature falls.
- B The condensed liquid of the fraction is collected in a tray.
- C When a fraction in the vapour cools to its own boiling point, it condenses.
- D **1** This is how the distillation process in the fractionator works.
- E Most of the fractions in the crude oil evaporate.
- F The condensed liquid flows out of the fractionator through a pipe from the tray.
- G High-pressure steam is used to heat the crude oil to a high temperature.
- H The crude oil vapour enters the fractionator and rises up the column.

4 Complete these sentences using each word from the box once only. Use capital letters where necessary.

for, as, that, to, by, which, when, from

- 1 Jet fuel is made from kerosene, _____ condenses between 175° C and 325° C.
- 2 _____ naphtha vapour is cooled to between 60 and 100° C, it condenses.
- 3 Diesel oil is produced _____ cooling crude oil vapour to between 250 and 300° C.
- 4 _____ crude oil vapour rises through the fractionator, it cools.
- 5 Lubricating oil is used _____ reducing friction between moving parts.
- 6 The boiling point of industrial fuel oil ranges _____ 370° C to 600° C.
- 7 A fractionator is a tall column _____ is filled with trays or plates at several levels.
- 8 The trays in the column are designed _____ allow contact between vapour and liquid.

5 Rewrite these sentences using the passive form of the verbs.

- 1 You have to refine crude oil so that you can use it for petrol or jet fuel.
Crude oil _____ so that it _____ fuel.
- 2 In the past, people burnt crude oil in lamps, but now they extract kerosene from it.
In the past, crude _____, but now kerosene _____ it.
- 3 When you boil crude oil, you convert most of the fractions into vapour.
When crude oil _____, most of _____ vapour.
- 4 The trays collect the condensed fluid and then a pipe carries it out of the fractionator.
The condensed _____ trays, and then it _____ pipe.

Word list

6 Write the meanings of these words and phrases in your own language.

NOUNS

- asphalt _____
- column _____
- fraction _____
- fractionator _____
- furnace _____
- hydrocarbon _____
- kerosene _____
- naphtha _____
- petroleum _____
- propane _____
- residue _____
- substance _____
- tray _____

NOUN PHRASES

- boiling point _____
- crude oil _____
- diesel oil _____
- fractional distillation _____
- fractional distillation column _____
- fuel oil _____
- high-pressure steam _____
- industrial fuel oil _____
- jet fuel _____
- lubricating oil _____
- oil refining _____

VERBS

- bubble _____
- collect _____
- extract _____
- separate _____